III. Cable Modem Service Necessitates More and Larger Equipment in the ROW

Extensive equipment in the public ROW is necessary to provide advanced two-way services. Each level of advanced services requires additional equipment (as well as additional fiber and node segmentation.) The new, larger equipment most significantly creates the following burden on the public ROW:

3.1 Power Supplies

Power supplies must be constructed in the ROW to power the new services and increase the level of reliability in the event of commercial power operations. **A** power supply connects the cable system to the power utility and provides backup power in the event of a power outage. Since the mid-1980s, most video-only cable systems were designed for two-hours of stand-by power. **In** contrast, many cable companies are currently designing their systems for four hours of power to offer reliable data or advanced services. **As** more advanced services are offered, even larger power supplies are necessary.

Power supplies and additional batteries are usually located in cabinets on poles, in ground-level cabinets, or in underground vaults. In general, the longer the required backup time, the larger the size of the cabinet for the power supply, with sizes ranging from a large toaster oven to a large refrigerator; examples are discussed in Section 3.2.

Provision of advanced services also requires a significant increase in the number of power supplies. **A** typical rebuild of the late-1990s or early-2000s increases the number of power supplies by a factor of three in the public ROW.

An additional burden is created by the danger inherent in placing such large power supplies in the public ROW. Because they contain batteries and connect to the power service, power supplies require scrutiny from utility inspectors in order that they not provide a hazard to the public or utility workers.

Systems designed for video-only services require much less power than systems designed for two-way advanced services. The relatively small amount of fiber optics in a video-only system, without redundant optical components, requires a smaller number of power supplies. Video-only systems are not required to operate for long periods of time in the event of power failure, so fewer batteries are needed, and smaller power supplies are adequate.

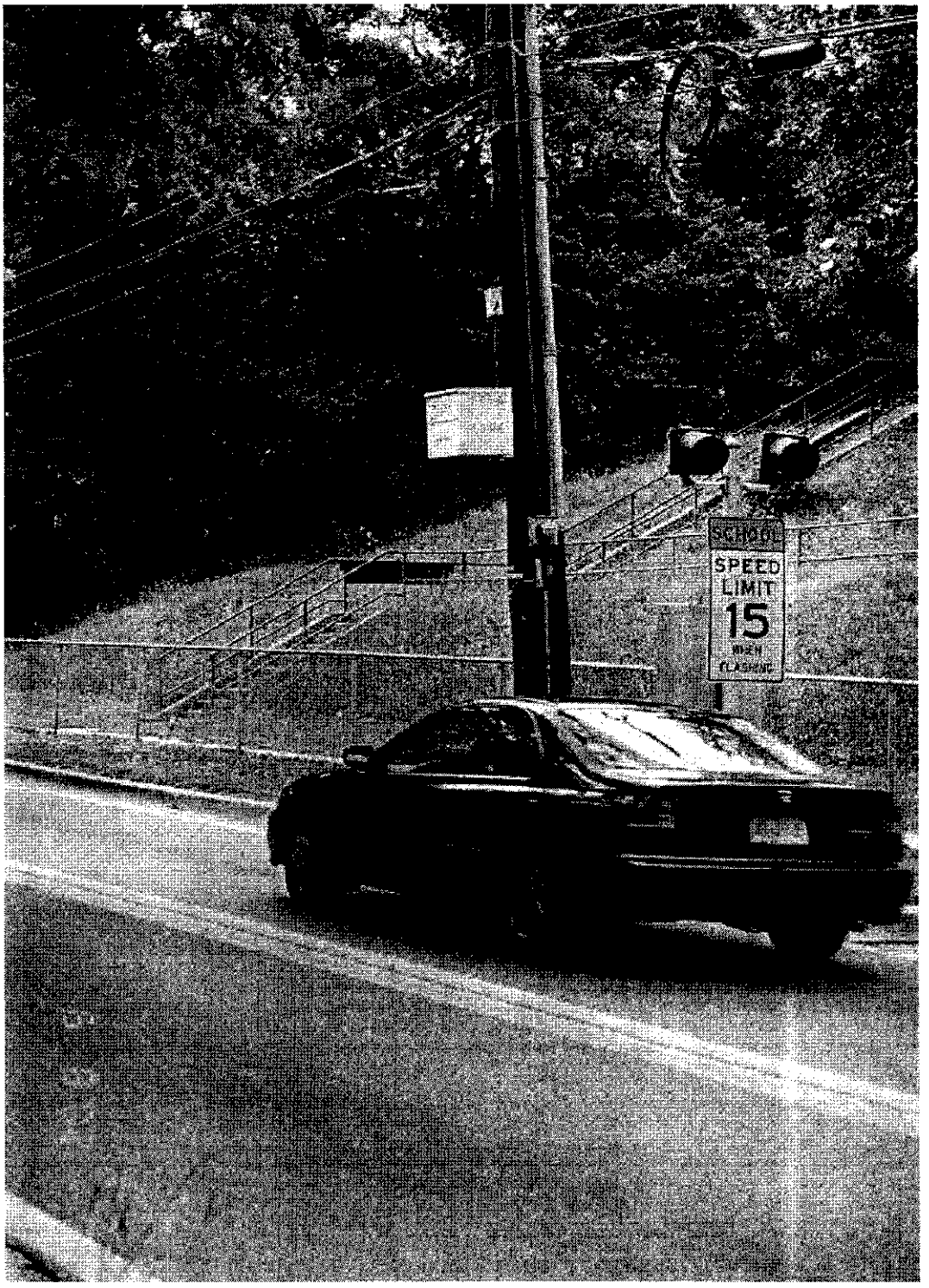
3.2 Equipment Cabinets

In addition to those that house power supplies, cabinets of sufficient number and size are installed on poles and on the ground in order to hold equipment such as nodes, slack cable, splice enclosures, multiplexers, and other equipment necessary to provide cable

modem service. Taken together, design enhancements for two-way advanced services require equipment located in numerous new pedestals and cabinets, which proliferate as a cable system is upgraded. Moreover, based on our experience with the most advanced cable systems, the cabinets and pedestals will increase in number and size as more advanced two-way services are provided over the cable system.

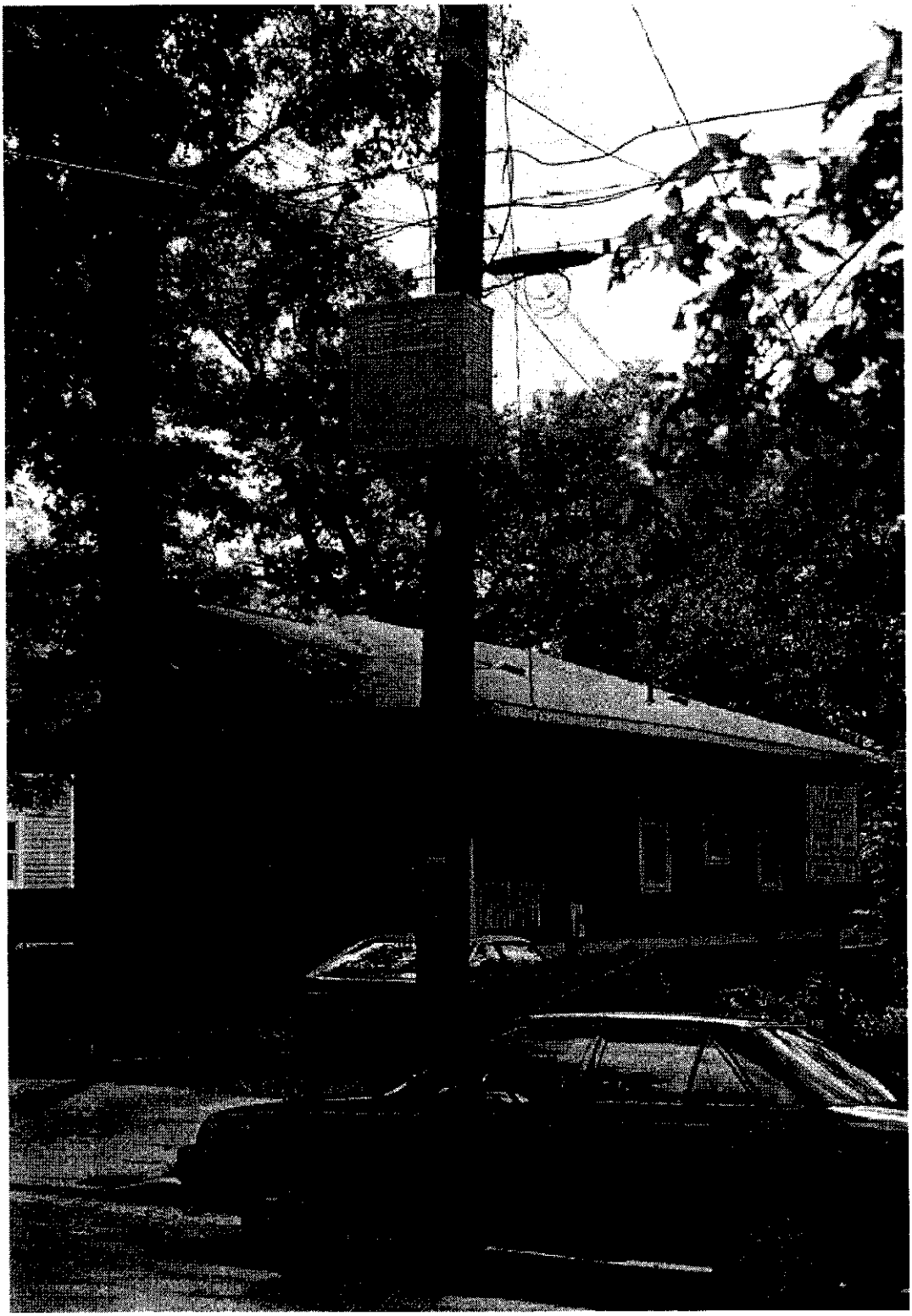
Cabinets installed in the late-1990s and early-2000s are significantly larger than those used in video-only systems, as illustrated by the cabinets currently deployed in the public ROW in the city of Takoma Park, Maryland. In this community, the incumbent operator, Comcast, has rebuilt to a standard hybrid fiber-coaxial system and deployed many new power supplies in the rebuild. Its cabinets (Photograph 5) are approximately the size of a microwave oven, and are adequate for provision of video and first-generation two-way services.

Photograph ***5***

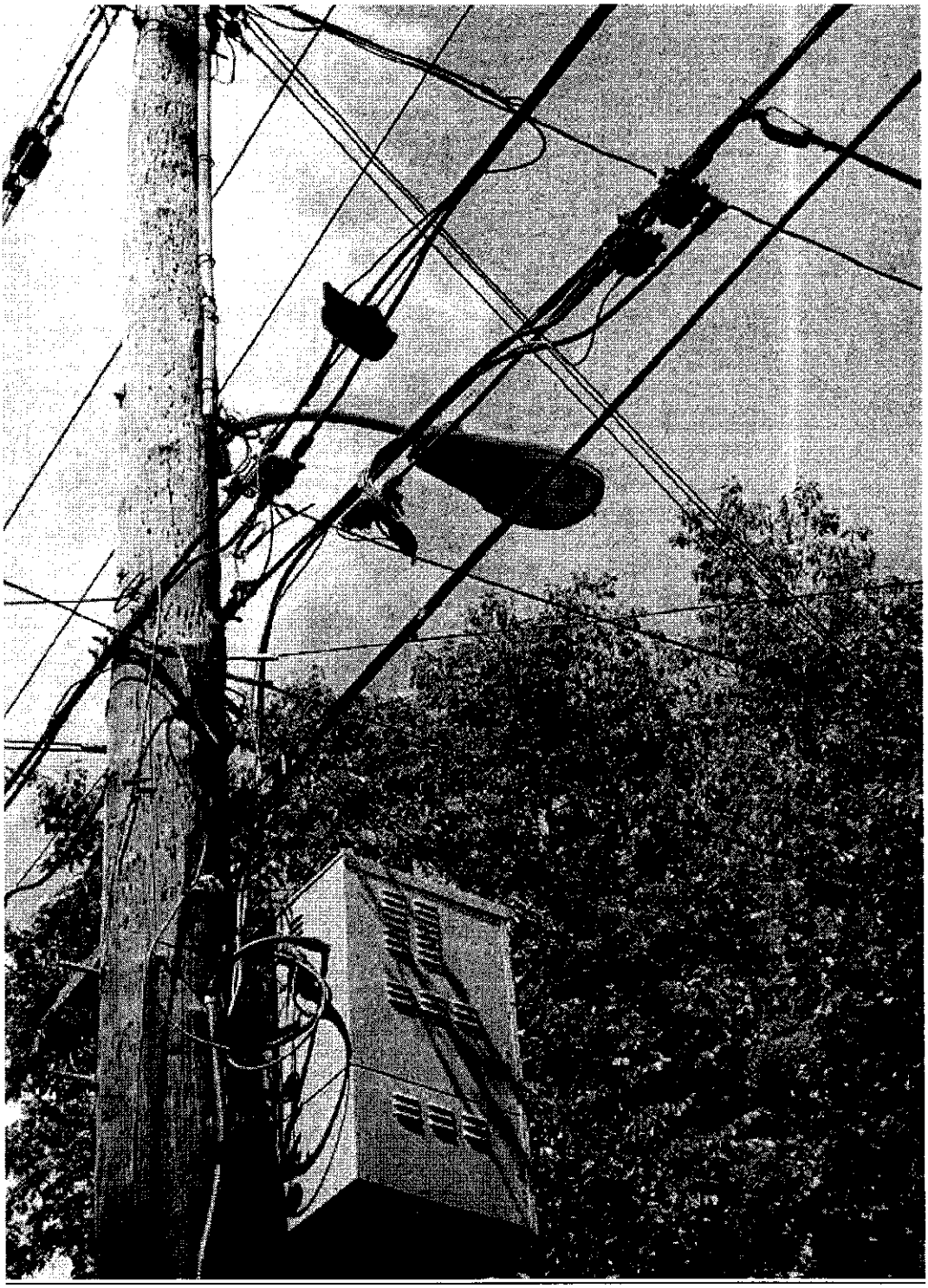


In the same jurisdiction, Starpower Communications, has "overbuilt" Comcast with a more advanced system designed for even more advanced services such as circuit-based telephony. Starpower's cabinets (Photographs ***6*** and 7) are the size of a refrigerator and are two to three times more numerous than those of Comcast. Starpower's construction offers a preview of what the future holds for the public ROW when cable companies upgrade further to offer future generations of advanced services over the cable modem.

Photograph ***6***



Photograph 7

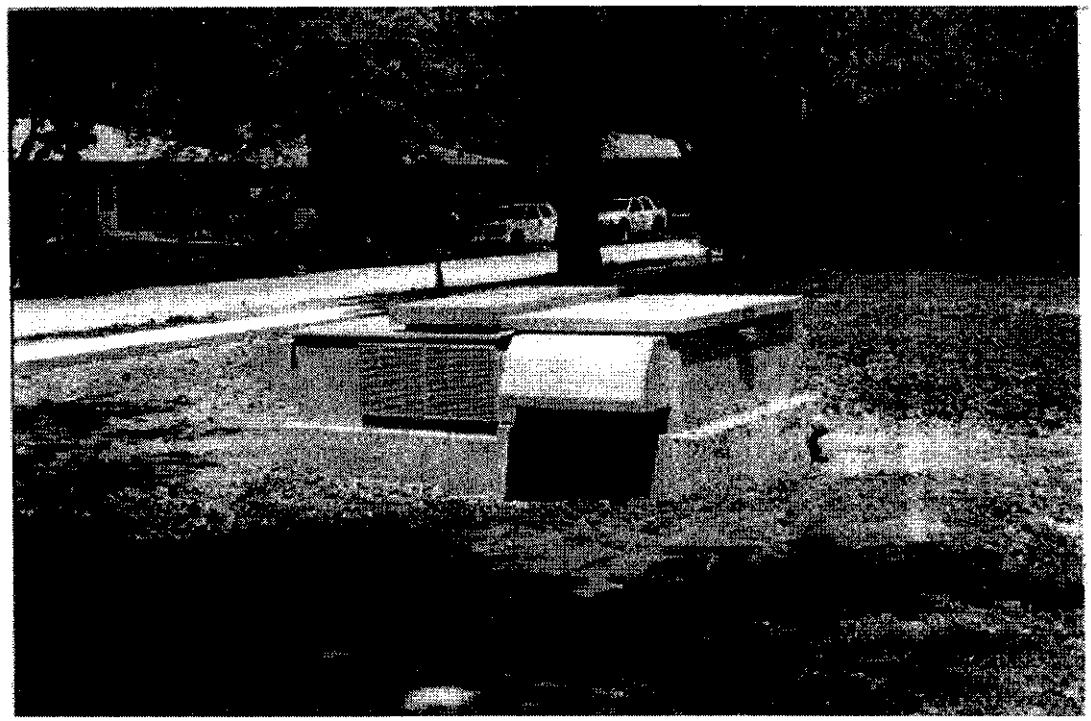


3.3 Prefabricated Buildings and Equipment Vaults

Hubs or optical transition node (OTN) facilities are constructed in rebuilt systems to serve areas of 10,000 to 30,000 customers and house cable modem routers, backbone fiber optic electronics, fiber termination panels, telephone multiplexer equipment, power supplies, and power generators. They are typically located in prefabricated buildings on private or public property or underground. They usually connect over redundantly routed fiber to a cable headend or network operations center. These hubs and OTNs are necessary to aggregate two-way traffic for customers into a reliable network backbone. In contrast, video-only systems usually have no need for hubs or OTNs and simply directly connected a headend to the cable plant without all the intermediate buildings necessary to provide advanced two-way services.

In some cases, cable modem upgrades have shifted much of the equipment burden from private property to the public ROW. In areas where real estate costs are high and zoning laws are strict, it may be more cost effective for a cable operator to locate its hubs in underground vaults in the public ROW than in prefabricated buildings. For example, in Skokie, Illinois, AT&T Broadband located much of its equipment in vaults installed in the public ROW rather than, as in the past, on private property in enclosed buildings. The result is the deployment of room-sized vaults under the ROW (Photograph 8) and all the attendant burden on the public land above and around the vaults.

Photograph 8

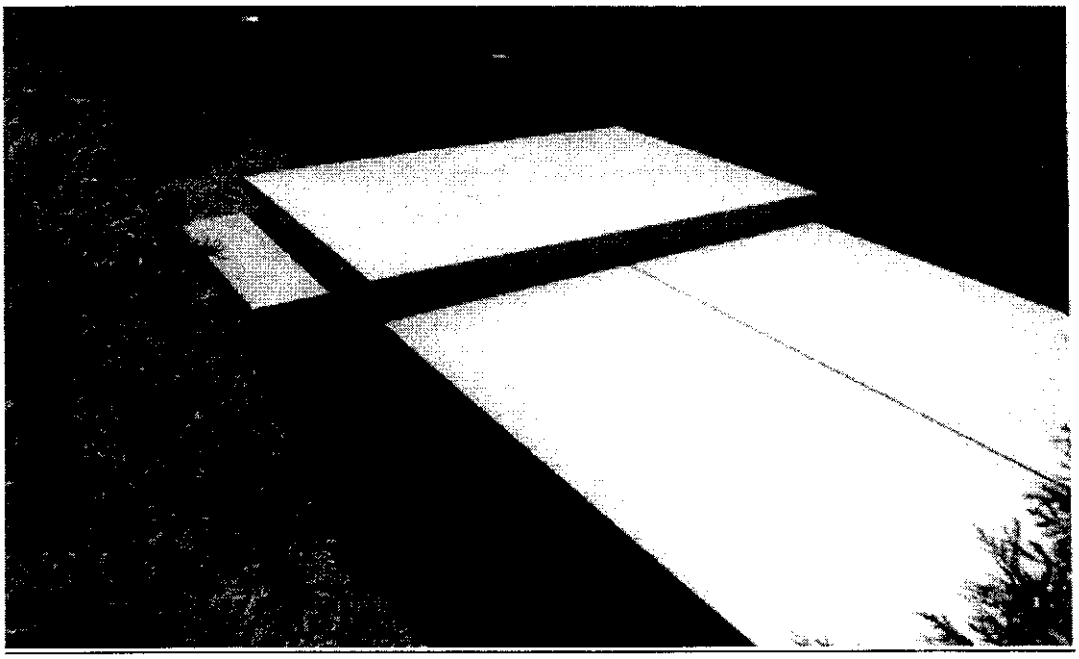


The size and number of these vaults will continue to increase as cable companies offer more advanced services to greater numbers of customers. Skokie also has an overbuilt system[5] that represents one of the most technologically sophisticated systems in the country. The system was designed and engineered to enable the provision of many of the advanced services currently being considered by the entire cable industry, including commercial-quality voice and data services. Three underground vaults were constructed. Each vault is living-room size and necessitates independent power service, air conditioners, and generators (Photographs 9 and 10).[6] **All** of the vaults are located on public property – two in the public ROW and one on Village property.

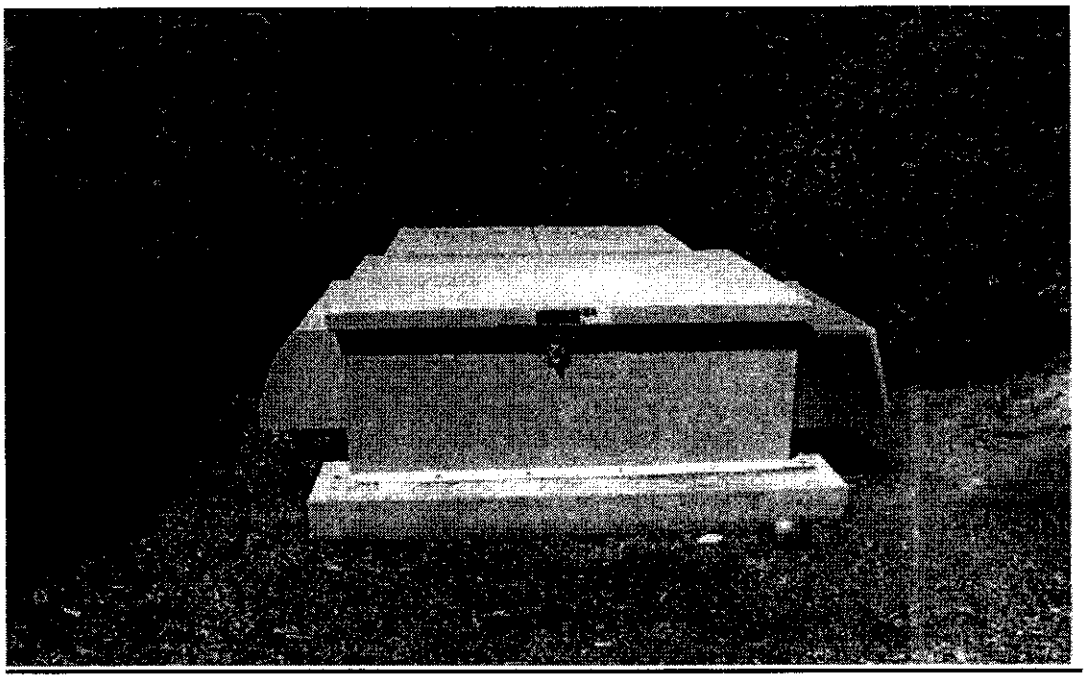
[5] The system is currently owned and operated by RCN Communications. The system was constructed in the late 1990s by 21st Century Communications.

[6] The local government in Skokie received numerous citizen complaints about the noise made by one of the air conditioners, which was then replaced by RCN.

Photograph 9



Photograph 10



3.4 Power Passing Taps and Plates

The tap is the point of demarcation between the cable on the public ROW and the drop cable serving an individual subscriber. A tap is located on the cable on a utility pole or in a small pedestal on the curb. Power passing taps are constructed for each residence or business served, in order to enable the provision of power to support such advanced services as telephony. Most cable companies either put in new taps or replace the tap plate. This new construction exists solely for the provision of cable modem and advanced services and serves no purpose with respect to video-only services.

3.5 Electrical Protection Devices

Electrical protection devices are added at the tap in the ROW, before each subscriber drop, to eliminate the possibility of electrical shock in the event the drop is cut, is disconnected, or malfunctions. **As** with power-passing taps, these devices are unnecessary for the provision of video-only services and were not contemplated by cable companies until they began to engineer their systems to enable advanced services such as telephony.

3.6 Fiber Receivers and Lasers

Additional fiber receivers and lasers may be constructed in every node in order to meet consumer expectations of reliability for data and voice services. Many systems have placed dual receivers and lasers in each node in order to support the redundant routing that is essential to offering some advanced services such as voice-over-IP. For example, some of the upgraded systems in the greater Los Angeles area were designed with this dual equipment, because the future provision of advanced services over cable modems was considered in engineering the upgraded systems. Similar increases in equipment will be necessary for other cable operators who wish to offer similar advanced systems.

IV. None of These Upgrades are Important or Necessary for Video-Only Services

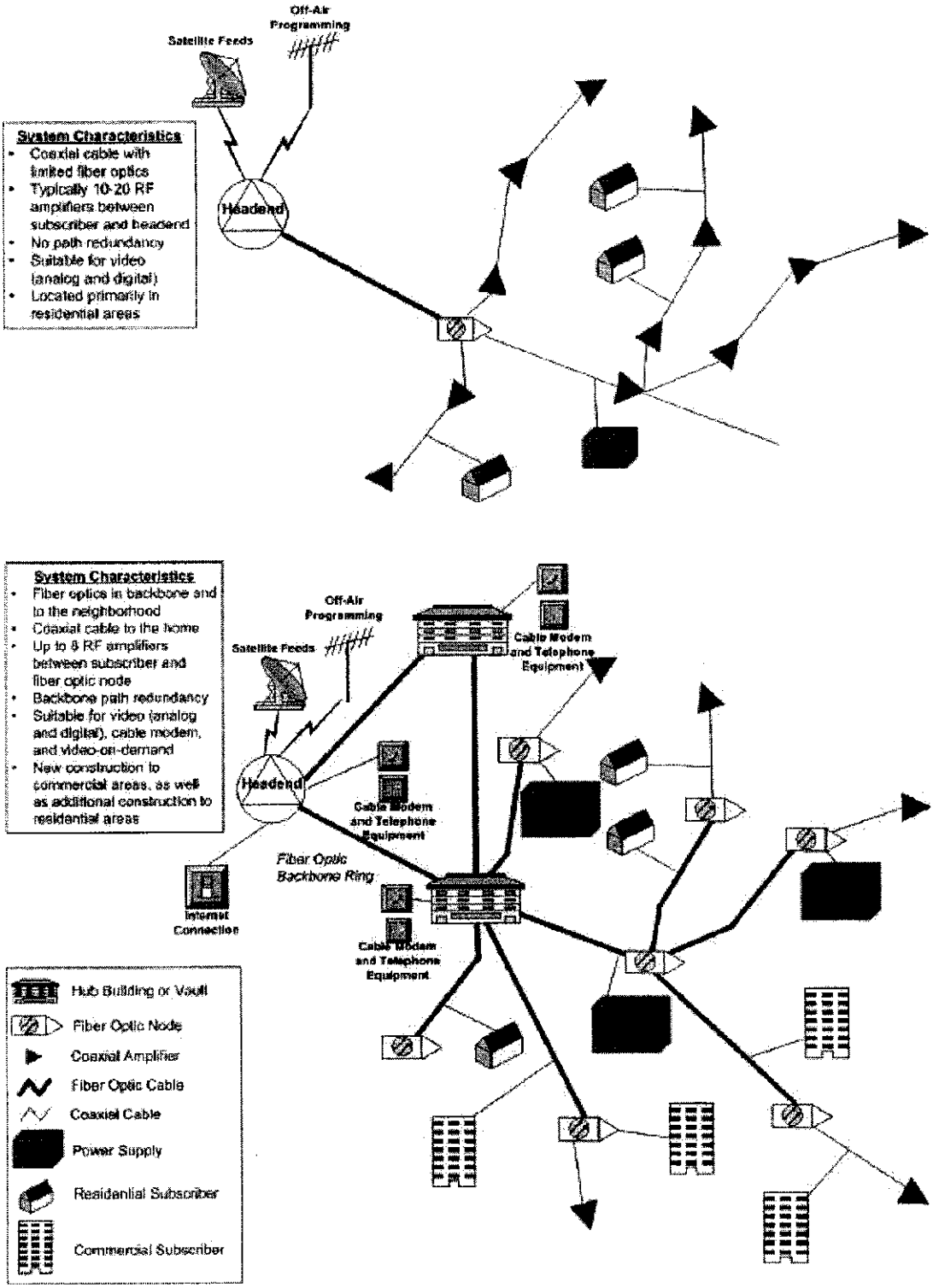
From a technical standpoint, the cable systems that existed in the early 1990s were fully capable of offering the range of video-only services that are offered today over American cable systems. Only minimal upgrade was necessary from a 1994 or 1995 system in order to offer the analog and digital services that are available in 2002.

Video-only systems require a transmission system that reliably transmits high-quality video signals to the subscriber and enables the subscriber to select basic, premium, pay-per-view programming in analog and digital format. A cable system with a headend equipped with satellite receivers, off-air antennas, modulators, digital up-converters, and limited fiber optics (for cascade reduction) can provide hundreds of high-quality video channels to subscribers, with the ability to purchase impulse pay-per-view and use other interactive set-top features.

In contrast, the extensive, costly upgrades of recent years were designed to meet current and future needs for advanced services over cable modems, including data and voice services. These systems would not have been upgraded at all if it were not for the need to offer two-way services.

Figure 2 illustrates the dramatic difference between a cable system designed for video-only services and one designed for cable modem services.

Figure 2


Satellite Feeds
Off-Air Programming
Headend
System Characteristics
• Coaxial cable with limited fiber optics
• Typically 10-20 RF amplifiers between subscriber and headend
• No path redundancy
• Suitable for video (analog and digital)
• Located primarily in residential areas
System Characteristics
• Fiber optics in backbone and to the neighborhood
• Coaxial cable to the home
• Up to 8 RF amplifiers between subscriber and fiber optic node
• Backbone path redundancy
• Suitable for video (analog and digital), cable modem, and video-on-demand
• New construction to commercial areas, as well as additional construction to residential areas
Satellite Feeds
Off-Air Programming
Headend
Cable Modem and Telephone Equipment
Cable Modem and Telephone Equipment
Fiber Optic Backbone Ring
Internet Connection
Cable Modem and Telephone Equipment
Hub Building or Vault
Fiber Optic Node
Coaxial Amplifier
Fiber Optic Cable
Coaxial Cable
Power Supply
Residential Subscriber
Commercial Subscriber

V. All These Trends Will Continue

As a result of all these needs, cable companies have deployed fiber optics deep into their systems and have done so in a way that will enable them to build out fiber even further in coming years, possibly even to individual homes ("fiber to the curb") and into the home itself ("fiber to the home"). All these developments result in increased impact, both now and in the future, on the ROW.

RCN's cutting-edge systems in Takoma Park and Skokie illustrate the future of cable systems in the ROW: a future of more and larger pedestals, cabinets, vaults, and power supplies. **As** fiber is extended from the neighborhood node to the immediate neighborhood (as in Skokie and Takoma Park), then to the curb, then to the home (or business), fiber optic cable will need to he lashed to aerial cable, or trenched, or bored beneath the ROW. Where the fiber travels and terminates, it will need to be stored and connected to electronics. The electronics, in turn, will need to be powered, and will require power supplies, batteries, and inspection.

It is our experience that such upgrades result in resident complaints about noise, appearance, and disruption, as well as in the need for local governments to increase electrical and other inspections to verify that public safety is not compromised. These trends will only continue and increase in response to the rapid advance of technology and the consumer demand for more advanced two-way services.

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